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A MULTIOBJECTIVE OPTIMIZATION TECHNIQUE FOR CARPOOLING USING GENETIC ALGORITHM ON ANDRIOD

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ABSTRACT

Carpooling is means of vehicle sharing in which driver share their car with one or more riders. It increases occupancy rate of cars by decreasing number of empty seats. This project proposes an multiobjective optimization carpooling system.

For an organization, sometimes it may be challenging to solve parking problem as huge number of employees working for organization having their own cars. To solve that parking congestion issue MOCS categorized employee into two level namely as Driver and Seeker. Both having their own constraints. MOCS uses Genetic Algorithm (GA). The genetic algorithm is a process used to solve both constrained and unconstrained optimization problems that is based on natural selection methods, the process that drives biological evolution. GA help to match constraints of seeker with constraints of driver. So that we get best optimized solution.

KEYWORDS: Optimization, Genetic Algorithm, Carpooling, Multiobjective Problem, Constraints, traffic congestion.

I. INTRODUCTION

Recent Economic development has resulted in urban and industrial growth, leading to rapid increases in number of vehicles on roadways thus, serious traffic congestion problems in large cities around the world.[1] Traffic congestion can have many fatal effects, such as time loss, air pollution and increased fuel consumption. Carpooling is eco-friendly transportation system in which empty seats of vehicle are offered to passengers and it is found to be one of the best solution to traffic congestion.

Carpooling helps to reduce traffic congestion problem and increase the number of occupation rate. So it is an effective and efficient solution. In carpooling, drivers share their empty seats with one or more additional passengers whose destinations are similar. This may reduce number of personal cars on roadways.

Carpooling can be a cheap, easy and enjoyable way for staff to travel to and from the workplace. It is a great alternative solution for employees coming from the same area and where transit is limited.

What exactly is car pooling?

Carpooling is an arrangement by which two or more commuters shares their proposed driving services to travel to and from their workplace from home or prearranged meeting area.

MOCS provides carpooling service to employees working within same organization.

Why estsblish car pooling to staff?

For staff members that regularly drive to work alone, car pooling is often regarded as the easiest, efficient and most convenient way for them to make a change to a more sustainable travel mode. People may be renitent to surrender the flexibility associated with driving are therefore more willing to either drive others or travel as a passenger.

In MOCS, Genetic Algorithm(GA) is used to solve constraints matching problem. Genetic algorithms are stochastic search methods introduced by J Holland in the 1970's and inspired by the biological evolution of living beings.[2] GA belongs to the larger class of evolutionary algorithms (EA), which generate solutions to optimization problems using techniques inspired by natural evolution, such as selection, inheritance, crossover and mutation. The new generation evolves from the population of existing individuals and it continuously goes from selection, crossover and mutation to improve over generation by eliminating weak individuals and it uses best few for further generation.

FLOWCHART:[3]

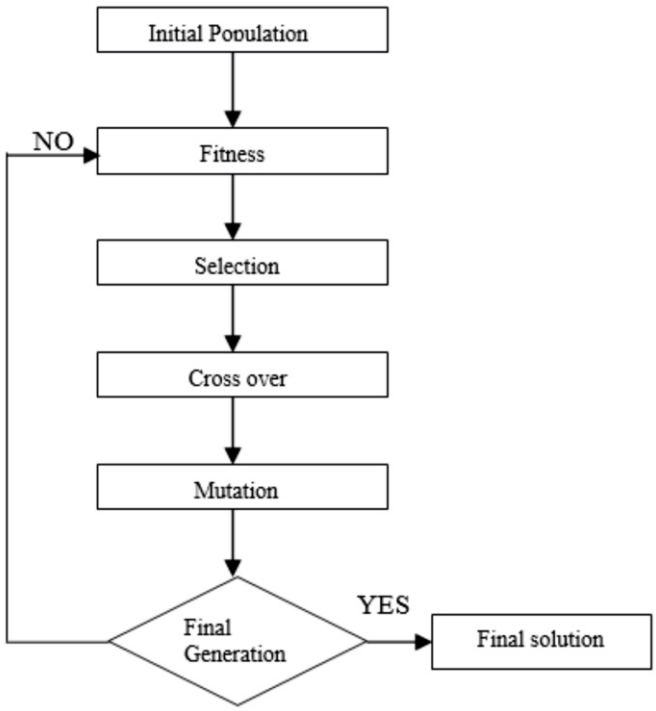

Figure 1 Genetic Algorithm

The figure shows the Genetic Algorithm. It has 5 steps

A. Initial Population

In the initialization procedure, each seeker is randomly chosen and assigned to a driver in the assignment layer of a chromosome. The chosen seeker is marked to prevent the seeker from being assign twice.

B. Fitness

To find the quality of the chromosomes in population the fitness function is used.

C. Selection

The first phase involves sorting the chromosomes into a descending order according to their fitness values, and selecting those with the highest values in the population. This gives with the with the highest fitness values from one generation to next.

D. Crossover

After the optimal chromosome have been selected, the chromosome crossover

procedure is utilized to recombine the chromosome of selected parents to simulate the natural process of evolution .

E. Mutation
It is used to change the allocation of the seekers mutually.

II. MOTIVATION

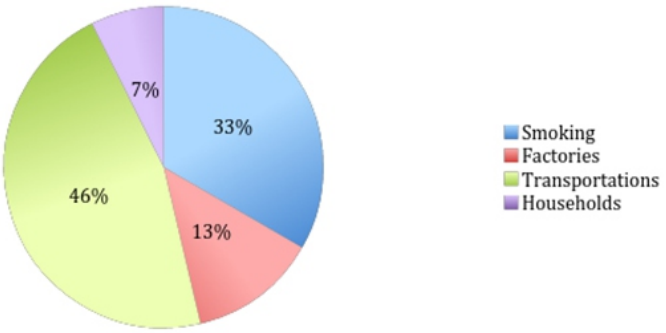

Figure 2 Factors affecting air pollution

There are various factors which contribute to air pollution. From the chart it is seen that 46% is from transportation sources which is the majority. These statistics made us think of a technique by which the on road vehicles can be reduced, without affecting the day to day lives of the people.

Severe traffic congestion can have many detrimental effects. Public transportation system have the capacity to decrease traffic congestion but offer less flexibility, and , comfort ,and freedom than personal vehicles ,so personal vehicles are by far the most popular way to commute. However, each car usually transports just one or two individuals, resulting in many empty seats. To increase occupancy rate of empty seats, we proposed Multiobjective Carpooling System (MOCS).

III. LITERATURE SURVEY

We had studied different papers which are based on carpooling concept .We conclude that transportation is a major issue in our world today. Carpooling is a solution to the problem of traffic jams, pollution , and extra use of fuel. Our application is an attempt to make a system which is user friendly and provides an opportunity to share cars. The service will allow users to offer and request ride sharing journeys using their Android enabled phones. Android is one of the fast leading growing mobile platforms used today. It is also open source software and developers can avail of the android SDK for free.[4] The minimal set up time and the number of tools available for android SDK to ease the development process allows the developers to concentrate on the design and implementation details of the application in the available time frame. The main objective of this paper is to experience developing an android mobile application which is one of the booming trends in computing industry. Thus we are using Android App as an integral part of MOCS.

The table shows some reference papers that describe Carpooling mechanism in different ways and technologies.

Year	Paper Name	Observations
Dec-2012 [5]	Optimization for Dynamic Ride-Sharing: A Review	This paper proposed dynamic ride-sharing system. Dynamic ride-sharing systems aim to bring together travelers having same itineraries and time schedules on short-notice. It is an effective and efficient optimization technology that matches drivers and riders in real-time. These systems may provide significant societal and environmental benefits by reducing the number of cars used for personal travel and improving occupancy rate of seat.
Jan- 2015 [6]	MoCaS:Mobile Carpooling System	This paper introduces MoCaS – Mobile Carpooling System –, a carpool service offered for registered users. In this system, each user can enter his travels and make appointments, assign ratings, register vehicles and add travel preferences. All this is possible via a web interface and also via a mobile application that together give greater support to those seeking such services. this system provides a real-time map, where all trip stops are visible as well as location of carpoolers.
Apr-2015 [7]	Carpooling application for Android focusing on Authentication and Traffic analysis.	The proposed application aims at creating a system which will make ride sharing easier and provides a stable dynamic security system for users. The other feature include traffic analysis for the shortest route, so that passengers take the least time to reach their destination.
April-2016 [8]	Implementation of dynamic carpooling system.	In this paper they proposed Android based application that will enable to let people know if vehicles are available for carpool in their desired path they can sign in for it. People having this application on their cell phone can easily carpool with unacquainted people without worrying about security. This system include features like Reduced cost ,tools ,stress of driving ,reduced carbon emission, and traffic congestion.
June-2016 [9]	An implementation of genetic algorithm approach to solve carpool service problem using cloud computing.	This paper proposes an Intelligent Carpooling System called ICS and also describes the costing charges applied on the passengers enjoying carpooling services. The driver and passenger matching is done via the Genetic Carpool Route and Matching Algorithm called GCRMA. According to this system drivers and passengers can access the carpool services exercised by the carpool agency through their simple handheld devices.

I. PROPOSED SYSTEM

Carpooling is also known as 'Ride Sharing' is one of the upcoming trends basically used for sharing vacant seats in the car on regular basis with individuals commuting on the same route on regular basis. Carpooling is usually supported by corporate to provide a means for the employees to reduce the number of vehicles used for commuting from workplace thereby reducing traffic and pollution on the roads.

Multiobjective Carpooling System (MOCS) is an Organization based carpooling system that means employees of the same organization can use carpool service provided by MOCS.

MOCS categorized employees of the organization into two categories- Driver and Seeker. Driver is also one of the employee of organization who is interested to bring his own car at workstation. Seeker is also the employee of organization, who acts like a passenger.

In MOCS, there is one Android App through which user can interact with system. User can make login as a Driver or as a passenger according to the role that they are playing in system. After login activity, User need to submit their details like personal information, contact details.

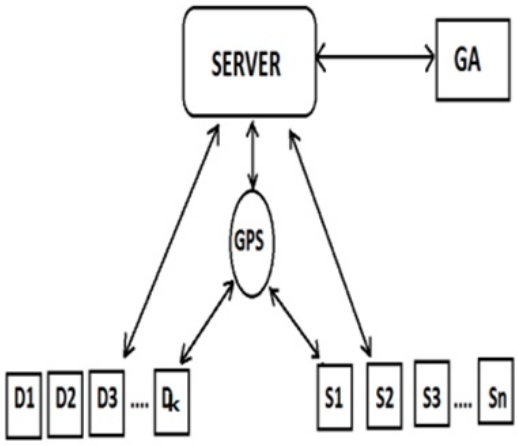

Figure 3 Architecture of MOCS

As figure 3, shows system architecture. There is huge number of employees working in the organization. Some e of them can play the role as Driver or as a Seeker according to their choice.

From the architecture diagram, It is clearly seen that there are 'n' number of Seeker such as S1,S2,S3… Sn which are assigning to 'k' number of Driver such as D1,D2,D3…Dn. For both driver and seeker it is necessary to submit constraints like source point, Gender, Habits like smoking, Requirement of window seat ,only female driver, only male driver required etc.

To assign driver for group of seekers ,it is necessary to match their constraints .as shown in architectural diagram

GA module is used to solve constraint matching problem.

This overall information stored into database which is provided as a back end. The front end will be developed using JAVA Android and the backend will work on MySQL database.

In this system GPS (GEO Positioning system) is also provided to simply track the location of passengers while traveling. Users can submit carpool requests to the MOCS which reflect their current locations via the use of smart, handheld, devices which feature GPS capabilities.

Scope and objectives of proposed system are given below:
1. Reduce pollution
2. Decrease in fuel consumption
3. Reduce congestion of vehicles in cities
4. Eco-friendly travel
5. Reduce stress of travelling
6. Reduce travel cost

In our application ,there are various tasks needed to be performed in appropriate manner. These task include authentication process, update profile registration, constraint matching and view result. It is necessary to performed various task involved in application in a sequentially.

A Sequence diagram is an interaction diagram that shows how objects operate with one another and in what order. It is a construct of a message sequence chart. A sequence diagram shows object interactions arranged in time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario.

Sequence diagrams are typically associated with use case realizations in the Logical View of the system under development. Sequence diagrams are sometimes called event diagrams or event scenarios .A sequence diagram shows, as parallel vertical lines (lifelines), different processes or objects that live simultaneously, and, as horizontal arrows, the messages exchanged between them, in the order in which they occur. This allows the specification of simple runtime scenarios in a graphical manner.

Figure 4 shows sequence diagram for Authentication process.

The users that have this application installed on their cell phones .According to diagram user needs to submit their valid username and password for login successfully.

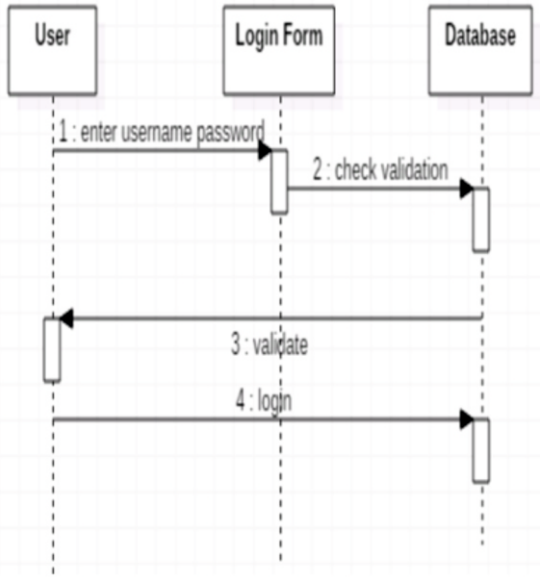

Figure 4 Sequence diagram for Authentication

Figure 5 shows interaction diagram for Update Profile activity. Each user should have their unique profile. Before registration process user needs to submit or update their profile including their constraints required for carpool service. This information gets stored at the back end. While updating profile ,existing details gets loaded. So user can easily update his profile.

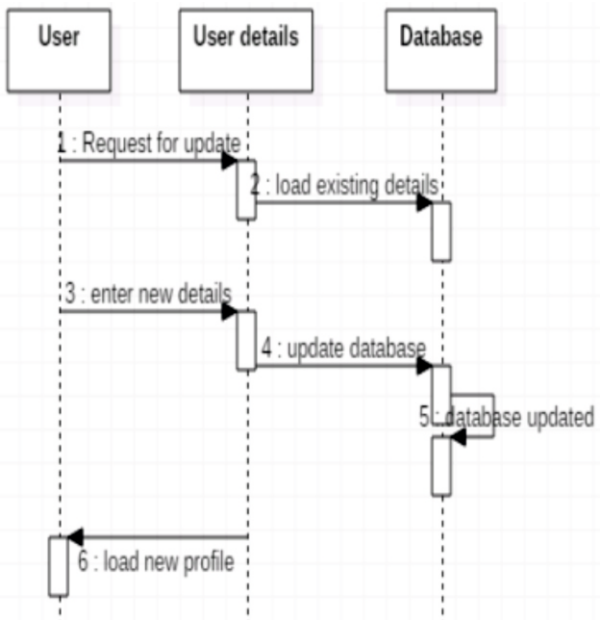

Figure 5 Sequence diagram for update Profile

Figure 6 shows that registration process which is carried out in the system. If new user want to participate in MOCS then that user must follow all this activity. It is process in which users can decide their role whether they want to act like driver or seeker. Job_name and job_id indicaes their role.

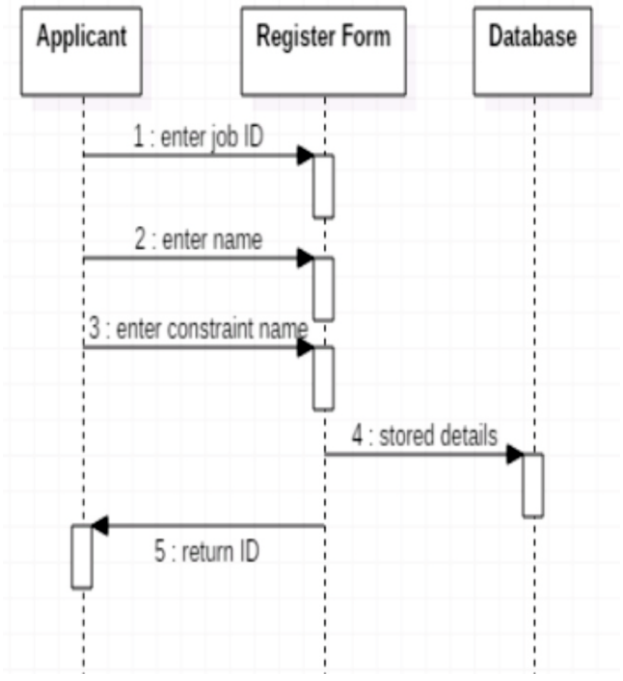

Figure 6 Sequence diagram for Registration

Figure 7 shows that constraint matching scenario.

In which GA start working and gives best optimized solution.

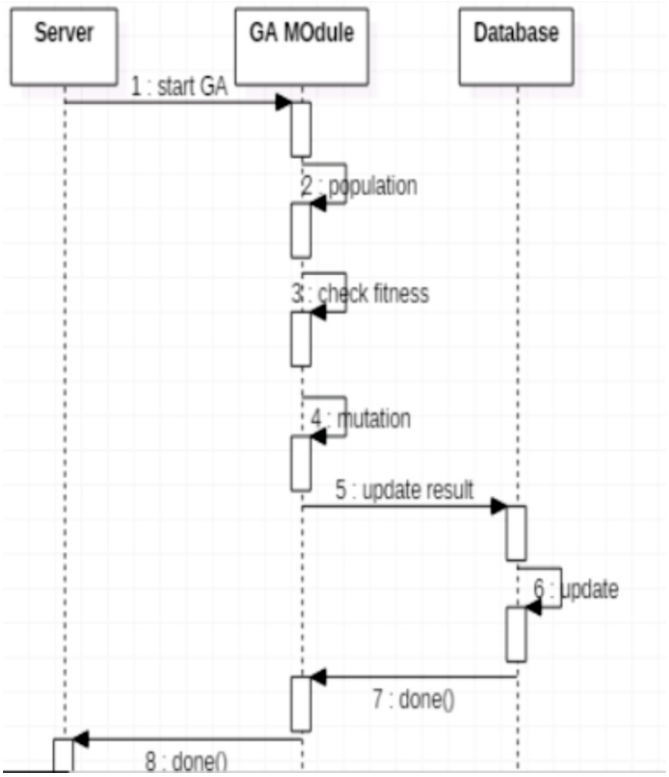

Figure 7 Sequence diagram for constraint matching

Figure 8 shows that view result, in which result fetch from the database which is generated by GA module and that result display on user's android cell phone.

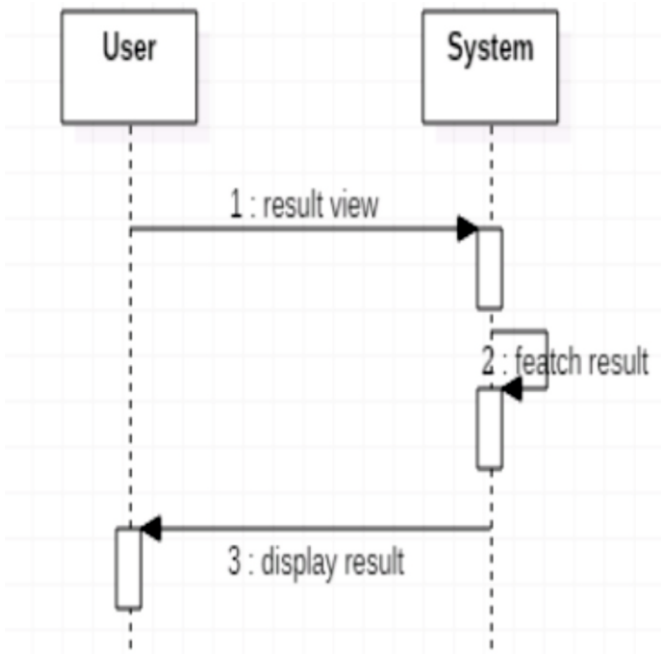

Figure 8 Sequence diagram for view result

V. CONCLUSION

This paper proposes a Multi-objective carpooling system.

It also provides an eco-friendly way to travel. As today most people prefer private vehicle to travel due to delay caused in public transport system. Pre-registration ensures security, as only identified people get into the vehicle so that trust can be established.

After receiving carpool requests of drivers and passengers from the MOCS, the respective requirements of driver and passengers in corresponding radial regions will be matched through the Genetic algorithm. The application brings together all the features which are needed to make sure that the services provided by it are secure and efficient.

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